

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, equipment, materials, and accessories as shown on drawings, specified, and required for the correct fabrication and installation of the fiberglass reinforced plastic (FRP) ductwork system, consisting of ducting, fasteners, field joints, expansion joints, fittings, and accessories.

1.2 REFERENCES

A. Referenced Standards: This section contains references to the following documents. They are part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section will prevail. Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.

1. SMACNA Thermoset FRP Duct Construction Manual.
2. ASME B16.5, Pipe Flanges and Flanged Fittings.
3. AWWA M45, Fiberglass Pipe Design.
4. AWWA C950, Standard for Fiberglass Pressure Pipe.
5. ASTM C581, Standard Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass-Fiber-Reinforced Structures Intended for Liquid Service.
6. ASTM C582, Specification for Contact-Molded Reinforced Thermosetting Plastic Laminates for Corrosion Resistant Equipment.
7. ASTM D2563, Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts.
8. ASTM D2996, Standard Specification for Filament Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
9. ASTM D3982, Standard Specification for Contact Molded Fiberglass Duct and Hoods.
10. ASTM D6041, Standard Specification for Contact-Molded "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Corrosion Resistant Pipe and Fittings.
11. ASTM E84, Surface Burning Characteristics of Building Materials.
12. PS15-69, Custom Contact Molded Reinforced-Polyester Chemical Resistant Process Equipment (Standards of Society of the Plastic Industry).

1.3 SUBMITTALS

A. Product Data:

1. Composition of materials, configuration of external stiffeners, and flexible connections.
2. Resin system data, including:
 - a. Chemical environment service test data.
 - b. Case history data of similar installations (with contact addresses).
 - c. Resin pot life and time versus temperature data required for complete resin cure for laminate thicknesses proposed.

B. Shop Drawings: Specific to the project and applicable product data will be provided in a single package and submitted as part of the FRP ductwork manufacturer's submittal. The following information shall be submitted as a minimum:

1. Drawings showing:
 - a. Ductwork layout, dimensions, fittings, transitions, bracing, and fasteners. Specific design parameters for this project specified herein.
 - I. Scaled duct layouts, dimensioned to show length of duct runs, duct sizes, support spacing, and expansion provisions.
 - II. Locations of external stiffeners and expansion joints.
 - III. Fabrication details.
 - IV. Support locations, types, and details.
 - V. Flexible connections.
 - VI. Duct sealants.
 - VII. Specifications for FRP resins and reinforcing material used.
 - VIII. FRP duct schedule with laminate construction, sizes, thickness, vacuum pressure, weight per foot pressure, spans, joint type, and flange data.
 - IX. Gasket material.
 - C. Manufacturer's Installation Instructions. Submit a certificate from the manufacturer of the castings indicating compliance with all applicable requirements of these specifications.
 - D. Other calculations, dimensions, or materials related to the specified product as requested by the Engineer.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. All equipment shall be the product of a single manufacturer having at least ten (10) U.S. installations of the type being proposed, each with a minimum of 5 years of satisfactory service.
2. A list of similar installations shall be furnished with the shop drawing submittal, including names and telephone numbers of contacts.

B. Inspection of factory-assembled equipment shall be accomplished by the manufacturer prior to shipment. Skid-mounted units shall be delivered fully assembled.

C. Comply with regulatory requirements of local, state, and federal agencies having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials according to the manufacturer's recommendations. Properly protect all parts so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed.

B. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect packaged materials from deterioration.

C. Store all materials in covered storage off the ground and prevent condensation in accordance with the manufacturer's recommendations for long-term storage.

PART 2 - PRODUCT

2.1 ACCEPTABLE MANUFACTURERS

A. Virtual Polymer Compounds, 10478 Ridge Road, Medina, NY 14103, www.vpcfberglass.com.

2.2 FIBERGLASS REINFORCED PLASTIC (FRP) DUCTWORK AND ACCESSORIES

A. The FRP duct system shall be specifically designed, constructed, and installed as shown on the drawings for the following minimum conditions:

1. General Temperature: -10°F to 240°F.

2. Corrosion resistance to airstream gases as needed. Corrosion barrier can be adjusted to meet resistance requirements.
3. All duct is designed for +/- 20" WG. Duct can be designed to accommodate pressure as needed.

B. FRP Duct Construction:

1. Standard resin used in the laminate shall be premium corrosion-resistant and fire-retardant AOC K022 brominated biphenol-A vinylester resin.
2. FRP ductwork shall be of filament wound (SMACNA Type X) or hand lay-up construction as needed (SMACNA Type II).
3. FRP ductwork shall be of flame-retardant material inside and outside and meet ASTM E84 Class 1 flame spread of 25 or less. Resin shall be Class 1 without any added fillers.
 - I. FRP exterior can be modified acrylic resin that complies with NFPA 90 for a Class 1 duct material having a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL according to ASTM E 84 if required.
4. Duct shall meet or exceed all applicable construction requirements of SMACNA FRP Duct Construction Manual.
 - I. Corrosion Barrier – Inner surface shall contain a resin rich layer 20 mils minimum.
 - II. ii. Structural Layer – Shall consist of filament wound continuous strand roving as required for design conditions. Minimum wall thickness of 0.1875" for 2" up to 12" diameter, 0.25 13" up to 36" and 0.375" 37" up to 72" diameter.
 - III. iii. Flanges and bolt drilling circles and diameters shall conform to SMACNA Thermoset FRP Duct Construction Manual.
 - IV. Exterior surfaces shall have a factory applied pigmented gel Coat finish with UV inhibitors added. Color standard is gray.

C. Maximum allowable deflection for any size ductwork shall be 0.5-inch between supports and for any side of duct under worse case operating conditions.

D. Fittings: All fittings such as elbows, laterals, tees, and reducers shall be of the same resin as duct, and equal or superior in strength to the adjacent duct section and shall have the same internal diameter as the adjacent duct.

E. Joints: All duct joints shall be butt wrapped or bell and spigot joints as shown on the Drawings as required. Bell and spigot joints shall be sealed with a standard butt joint overlay as provided by VPC. Flange joints can be provided as required and will be per SMACNA standards.

F. Total width of overlay for butt-wrap joints shall be not less than 6-inches for diameters from 2-inches up to and including 30-inches, 36-inch and larger shall be not less than 8-inches.

G. Standard Elbows:

1. Standard elbow centerline radius shall be equal to 1.5 times the diameter.
2. Standard elbows up to 24-inch diameter shall be smooth radius molded elbows.
3. Standard elbows 30-inch diameter and greater may be mitered sections as specified below.
 - I. 0° to 44° elbows shall contain one (1) mitered joint and two (2) sections. Elbows 45 or greater shall have a minimum of two (2) mitered joints and three (3) sections.

H. Control Dampers:

I. Round FRP dampers:

1. Round FRP dampers shall be the butterfly type. FRP fabrication shall meet the corrosion requirements specified in this section for FRP ductwork
2. Fabrication:
 - I. Frame and blade: premium vinyl ester. Blade shall fully encapsulate shaft. Blades that bolt to a single side of the shaft will not be accepted.
 - II. Shaft: Pultruded vinyl ester
 - III. Bearings: EPDM/Neoprene
 - IV. Pins and hardware: Type 316 stainless steel.
 - V. Shaft seals: EPDM/Neoprene
 - VI. Isolation dampers will have full circumference EPDM/Neoprene seals.
 - VII. Dampers shall have flanged ends or plain ends. Provide Type 316 stainless steel bolts, nuts and washers for flanged connections (By Others).
 - VIII. Balancing/Volume dampers shall have a fully adjustable slot with an extra hole drilled in the handle for contractor to "drill –and-pin in-place" once the system is balanced so handle cannot vibrate loose.

J. Accessories: All gaskets required shall be EPDM. Bolts, nuts, and washers shall be Type 316 stainless steel.

2.3. DUCT SUPPORTS

A. Provide duct supports as indicated on the Drawings. Supports and hangers shall be designed to accommodate all forces from duct work

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all ductwork in accordance with the manufacturer's recommendations and instructions and as indicated on the contract drawings.
- B. All ductwork shall conform accurately to the dimensions shown on the Drawings, the ducts shall be straight and smooth inside with joints neatly finished; ductwork shall be installed so as to preclude the possibility of vibration under all operating conditions.
- C. Install all ductwork and accessories to provide a system free from buckling, warping, breathing or vibration.
- D. All expansion joints and ducts shall be suitably supported at each end by support guides within 12-inches of joint.
- E. All ducts at flexible connections with fans shall be supported at free end within 12-inches of flexible connection.
- F. Provisions shall be made for supporting all ductwork, dampers, and other ductwork accessories, where required.
- G. Contractor shall receive field assistance, if required, from the corrosion resistant ductwork manufacturer to ensure that the corrosion resistant ductwork is installed and jointed correctly.

3.4. EXAMINATION

A. Examine areas to receive ductwork. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of ductwork. Do not proceed with installation until unsatisfactory conditions are corrected.

3.5. CLEANING

A. Remove all loose materials and obstructions from interior of ducts.

B. Remove debris and waste materials resulting from installation.

3.6. INSPECTION

A. ENGINEER reserves the right to reject any and all equipment found to have the following: blisters, chips, crazing, exposed glass, dry cracks, burned areas, dry spots, foreign matter, or entrapped air at the laminate surfaces which do not satisfy the tolerances specified in ASTM D 2563, Table I Acceptance Level II inside and outside surfaces. Unacceptable Barcol hardness and acetone sensitivity shall also be cause for rejection.